

Massive right heart thrombus after the Nuss procedure: A case report



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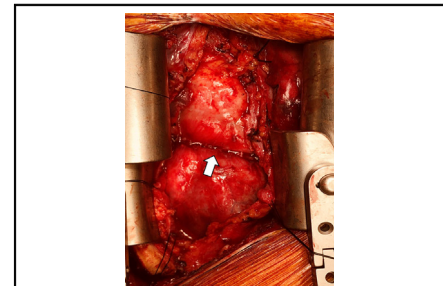
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The flipped bar causes direct compression on the RV, developing massive thrombi.

CENTRAL MESSAGE

A rare presentation of massive intracardiac thrombi occurred after the Nuss procedure in an adult patient. A novel sternal-sparing approach was performed to address the condition.

▶ Video clip is available online.

The Nuss procedure is a minimally invasive repair well known for pectus excavatum (PEX) correction.¹ Recent studies have shown encouraging results in adult patients with an acceptable rate of minor complications.^{2,3} We report a case of an adult patient who developed localized pericardial constriction with massive right heart thrombi after the Nuss procedure. A novel sternal-sparing approach including surgical thrombectomy, tricuspid valve replacement, and a concomitant re-do open Nuss and modified Ravitch procedure is described. The Institutional Review Board of Taipei Tzu Chi Hospital approved the publication of data. The patient provided informed written consent for the publication of the data.

CLINICAL SUMMARY

A 43-year-old woman presented with progressive shortness of breath, pleuritic chest pain, and palpitation 1 month after a thoracoscopy-assisted Nuss procedure. Her medical history before the procedure included severe PEX with a Haller index of 7.5 without major cardiac abnormalities. Further workup confirmed bar migration contributing to pericarditis symptoms. During the bar removal procedure, unexpected large and floating thrombi in the right atrium (RA) and right ventricle (RV) were detected by intraoperative transesophageal echocardiography. The patient was

urgently taken back to surgery with a multidisciplinary approach.

The exposure was achieved by a midline lower skin incision and left parasternal approach by elevating the pectoralis muscles bilaterally and dividing the third, fourth, and fifth costo-chondral cartilages, which greatly exposed the significantly left-deviated heart and facilitated the concomitant repair of PEX later (Figure 1, A). Dense adhesion was observed around the pericardial space, with a prominent “adhesion band” forming a local constriction on the RV, which appeared to be caused by direct bar compression (Figure 1, B). Cardiopulmonary bypass was established through peripheral cannulation. After cardiac arrest was achieved, the RA was opened, and the heterogeneous RA thrombi extending to the RV and outflow tracts were meticulously removed (Figure 2). The tricuspid valve was replaced with a bioprosthesis due to severe leaflet damage, which was considered irreparable. The RA was reconstructed with a bovine pericardium patch to conclude the cardiac procedure (Video 1).

The second stage of the procedure included open revision of her chest wall deformity. After pneumolysis, the bilateral fourth conjoint costal cartilages were resected, and a stainless pectus bar was placed for correcting the residual pectus

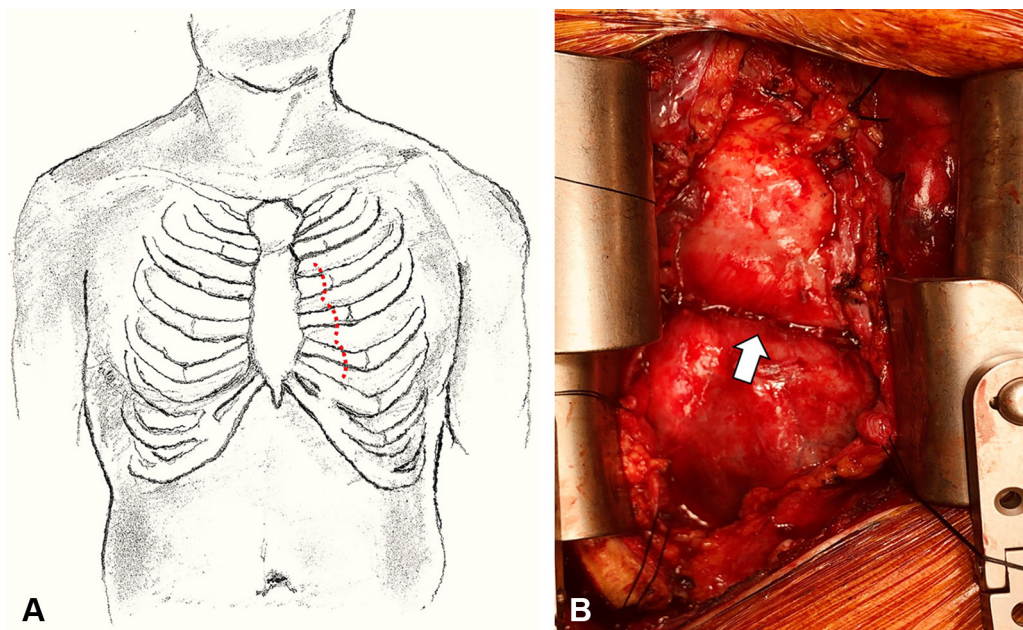


FIGURE 1. A, Left parasternal approach: dividing the left third to fifth costo-chondral cartilages (*dotted line*) after lower midline skin incision. B, Prominent “adhesion band” (*arrow*) forming a local constriction on the RV, which appeared to be caused by direct bar compression.

deformity as an “open Nuss procedure” followed by the modified Ravitch procedure. She made a full recovery and was discharged uneventfully on postoperative day 10. At the 6-month follow-up, she reported good physical and cosmetic results under gentle anticoagulant therapy with aspirin and warfarin.

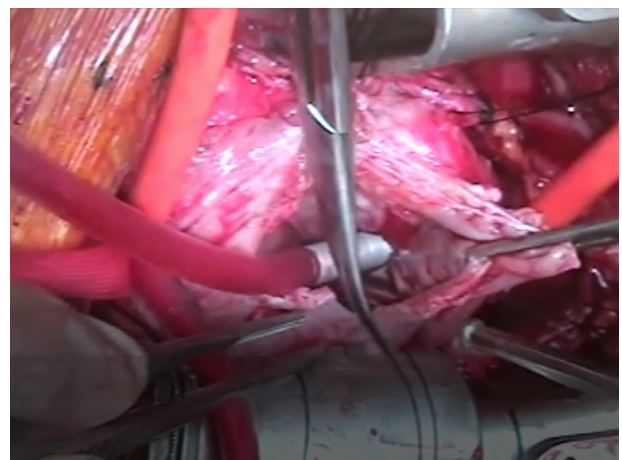
DISCUSSION

The Nuss procedure is a minimally invasive repair approach well known for PEx correction. It is considered most effective when performed in adolescence because of

the chest wall flexibility and compliance, yet several studies now have shown encouraging results in adult patients with acceptable rate of minor complications.^{2,3} In a similar case report, Maagaard and colleagues⁴ describe a 40-year-old patient who had right ventricular outflow tract obstruction more than 2 years after the Nuss procedure due to bar migration. Concomitant procedures, including costal cartilage resection, multiple bar placement, and sternal osteotomy, are often required to eliminate the extrinsic compression



FIGURE 2. Removed heterogeneously organized intracardiac thrombi.



VIDEO 1. Surgical thrombectomy and tricuspid valve replacement by a left parasternal approach in a patient with PEx developing a huge intracardiac thrombus after the Nuss procedure. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00018-9/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00018-9/fulltext).

and deformation effects of a rigid chest wall on the right heart and outflow tract.² In our previous experience, the incidence of bar displacement requiring reintervention was 3.4%,⁵ but no incidence of cardiac thrombi was observed. After comprehensive literature searches, we did not find a similar case report describing such a causal relationship among the Nuss bar migration, right heart compression, and massive intracardiac thrombosis.

Right heart floating thrombi or “embolus in transit” is a potentially life-threatening condition due to risks of pulmonary thromboembolism and right heart flow obstruction. The left-deviated heart in a concave-shaped thoracic wall and the presence of dense adhesion around the pericardial cavity both posed considerable technical challenges for concomitant heart surgery and chest wall reconstruction procedure. We present our innovative left parasternal approach, which involves the division of the third to fifth costochondral cartilages to avoid vertical sternotomy, thus not only preserving a stable sternum for the subsequent modified Ravitch procedure but also providing an excellent exposure of the deviated cardiac structures.

CONCLUSIONS

We report this rare complication of massive intracardiac thrombi after the Nuss procedure in an adult female patient. To the best of our knowledge, no identical case report has disclosed this causal relationship. Our novel approach concomitantly addressed both life-threatening massive right heart thrombi and PEx.

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